

HSL Workshop

April 2-5, 2002
University of Chicago

AURA/NASA/ESA

G. Illingworth
R. Kennicutt
Co-Chairs

www.aura-astronomy.org/hsl



**Hubble's Science Legacy:
Future Optical-UV
Astronomy from Space**

Recognizing the impact of the science produced by the Hubble Space Telescope, and the scientific potential of a larger aperture successor, AURA, in conjunction with NASA and ESA is organizing a workshop to consider opportunities presented by optical and UV astronomy in space after Hubble. Accordingly, the astronomy community is invited to identify the most compelling science questions in optical-UV astronomy that remain unanswered and the technological hurdles that need to be crossed in achieving them.

The scope of the scientific discussion should be very broad, encompassing problems in cosmology, extragalactic astronomy, stellar populations, the ISM, star and planet formation, stellar astrophysics, and solar system astronomy, all considered in the context of other ground and space missions producing discoveries in the 2010-2020 time frame. Visit the web site for further information and to register by January 31.

**Announcing a Workshop
on the science opportunities
in Optical-UV astronomy in space
after the Hubble Space Telescope
April 2-5, 2002
at the University of Chicago.
www.aura-astronomy.org/hsl**

Science Organizing Committee:
Co-Chairs:
Garth Illingworth, UC Santa Cruz
and Rob Kennicutt, Arizona
Steve Beckwith, STScI
Catherine Cesari, ESO
Jim Crocker, BATC/JHU
Alan Dressler, Carnegie Obs.
Andrea Dupree, CfA
Sandra Faber, UC Santa Cruz
Wendy Freedman, Carnegie Obs.
Alvaro Gimenez, ESA
Hashima Hase, NASA HQ
Richard Koo, Chicago
Simon Lilly, NRC
Jonathan Lunine, JPL
Duccio Macchetto, ESA/STScI
Jeremy Mould, NOAO
William Oegerle, NASA/GSFC
Ethan Schreier, STScI & AUI
Mike Shull, Colorado
Larry Simmon, JPL
Eric Smith, NASA HQ
David Spergel, Princeton
Meg Urry, Yale

Local Organizing Committee
Chris Blades, STScI
Colleen Duke, Adler Planetarium
Marilyn Evans, AURA
Richard Koo, Chicago
Ethan Schreier, STScI & AUI

AURA NASA THE UNIVERSITY OF CHICAGO esa

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Context

- HST de-orbit in ~2010 will leave astronomy without high-resolution capability in visible-UV (0.1 - 1 μ m)
- SUVO initiative proposed modest-aperture successor to AASC --> not recommended
 - modest planning effort continuing via SEU
- Need for a broader assessment of future science opportunities and feasibility of a large HST successor facility, for 2010-2020 time frame
- Initial focus on large (~8m) telescope with a large discovery potential
 - sensitivity 20-100x HST
 - angular resolution of order 10 milliarcsec over large fields
 - possible coronagraphic and/or adaptive capabilities
 - can assess merits vs smaller single/multiple missions

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Workshop Objectives

- Identify likely key science problems in 2010-2020 time frames: solar system --> cosmology
- Assess scientific need for post-HST space facility (diffraction-limited performance in visible- UV)
 - core science drivers
 - key science, important for defining technical capabilities
- Identify likely technological capabilities, key technical challenges for large visible-UV telescopes
 - critical assessment in light of 30m telescopes + AO, precursor space facilities
 - identify key areas for early or long-term technology investment, to enable facilities in 2010+

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Workshop Products

- **Published proceedings** (~50 invited talks + posters)
- **White paper**
 - distillation of principle outcomes of workshop
 - SOC (below) provided preliminary ideas based on workshop planning discussions
- **SOC**
 - G Illingworth, R Kennicutt, S Beckwith, C Cesarsky, J Crocker, A Dressler, A Dupree, S Faber, W Freedman, A Gimenez, H Hasan, R Kron, S Lilly, J Lunine, D Macchetto, J Mould, W Oegerle, E Schrier, M Shull, L Simmons, E Smith, D Spergel, M Urry

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(Anticipated) Science Drivers

- Exoplanetary systems
 - direct imaging of solar systems, earth-like planets
 - microlensing + transit observations of exoplanetary systems
- High-resolution imaging/spectra of distant galaxies
 - trace rest-UV, star formation without dimming bias
 - detailed dynamics, buildup of dark matter, stars, metals, central black holes
- Evolution of the IGM and galaxy halos
 - thousands of sightlines (through galaxies!) at all redshifts
 - detailed history of IGM structure, ionization, metal evolution
 - galaxy mass loss, superwinds, interaction with IGM
- Precision studies of weak lensing, map dark matter

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Science Drivers II

- The Galactic neighborhood
 - precision distances to >30 Mpc: a 3D map of the local universe
 - star formation histories of galaxies vs type, mass
 - definitive age scale, IMF determinations
- High-resolution imaging/spectra of AGNs
- Stellar astrophysics
 - surface imaging of stars, circumstellar structures, SNRs
 - stellar seismology of stars throughout the Galaxy
 - high-resolution studies of proto-planetary disks, jets
- Solar system
 - monitoring of planet weather, geological activity

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Technology: Optics

- Lightweighted optics with exquisite accuracy
- Fabrication technologies
- Active wavefront control (primary optics)
- High-reflectivity, durable coatings for visible - UV
- Coronagraphic optimization
- Adaptive optics for high-order wavefront correction
- Thermal control design, testing, demonstration
- Pointing/control systems for 10 milliarcsec imaging

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Technology II

- System design studies (e.g., weight, baffling)
- Orbit trade studies
- Detectors
 - high efficiency, dynamic range in UV
 - large formats, mosaics
 - photometric stability, high radiation environment performance
 - new technology, e.g., energy-resolving detectors
- Multi-mirror/shutter arrays
- Contamination control
- Launch vehicle, shroud constrains in 2015 time frame
- Options for on-orbit construction, assembly

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